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**CASPAN**  
Engineers and Constructors  
Houston, Texas



**Final Report  
to  
Johnson Spacecraft Center**

**NAS 9- 12698**

**June, 1975**

**CASPAN CORPORATION  
Engineers and Constructors  
Houston, Texas**

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## 1.0 BACKGROUND

Caspan Corporation was awarded contract NAS 9-12698 under which seven major tasks and several minor projects were accomplished throughout a three (3) year period.

- . The first task assigned to Caspan was the screening, cataloging and indexing of remotely sensed imagery (Missions 5 through 44). This task was broken into three phases; training, report preparation and the preparation of Index Coverage Maps.
- . The second task assigned was data extraction of land use information from the first edition Land Use Sheets.
- . The third task was the scribing of second edition Land Use Sheets. This task entailed both training of scribes and actual production of Land Use Sheets.
- . The fourth task accomplished was the collation of ERTS Investigation Reports. This task was divided into phases for each major report; Range, Forestry, Urban, Coastal, Signature Extension, Compendium and Agricultural Analysis.
- . The fifth task assigned under the contract was the preparation of SKYLAB IV Tabular and Plot Data for data bank entry.

- . The sixth major task was the preparation of the REDAF Documentary Data Base and LACIE Documents for data bank entry.
- . The seventh and final major task under contract NAS- 9 12698 was the preparation of overlays, Aircraft Mission Coverage, Large Area Corp Inventory Photograph Map and Ames Aircraft Flights.

## 2.0 ACCOMPLISHMENTS

### 2.1 Task I

Caspan began with the training of five (5) people for the preparation of Cataloging and Indexing Reports of Earth Resources Aircraft Remote Sensor Data. April 15 through April 30, 1972, concentrated on drafting techniques and map drafting. May 1, 1972, through May 16, 1973, the emphasis was shifted to NASA remote sensors and Cataloging and Indexing report preparation techniques. Caspan prepared thirty-seven (37) Cataloging and Indexing Reports ( 5, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44 ), between May 17, 1972, and November 14, 1972. These missions totalled two hundred and sixty-six (266) cans of film. Completed as part of Task I was the preparation of fifteen (15) Cataloging and Indexing Reports of University of Michigan Aircraft Missions ( 54M, 56M, 57M, 58M, 59M, 60M, 61M, 62M, 63M, 64 M, 65M, 66M, 67M, 68M, 71M). These were started on March 7, 1973, and completed on September 10, 1973. These missions totalled one hundred and one (101) cans of film. Manhour information is indicated in Figure 2.1.

Beginning on December 4, 1972, Caspan prepared Cataloging and Indexing reports for ten (10) post 200 missions ( 203, 204, 206, 210, 211, 212, 213,

SCREENING OF CATALOGING AND INDEXING REPORTS OF AIRCRAFT MISSIONS  
STATISTICAL DATA

UNIVERSITY OF MICHIGAN

| <u>Mission<br/>Number</u> | <u>Number<br/>Of Cans</u> | <u>Date<br/>Started</u> | <u>Completion<br/>Date</u> | <u>Total<br/>Manhours</u> | <u>Manhours<br/>Per Can</u> |
|---------------------------|---------------------------|-------------------------|----------------------------|---------------------------|-----------------------------|
| 54M                       | 5                         | July 2, 1973            | July 13, 1973              | 151                       | 30.2                        |
| 56M                       | 10                        | July 2, 1975            | Aug. 1, 1973               | 173.65                    | 17.36                       |
| 57M                       | 8                         | Aug. 6, 1973            | Aug. 17, 1973              | 146.35                    | 18.29                       |
| 58M                       | 5                         | Aug. 1, 1973            | Aug. 13, 1973              | 84                        | 16.8                        |
| 59M                       | 8                         | July 25, 1973           | Aug. 2, 1973               | 54.5                      | 6.8                         |
| 60M                       | 16                        | June 20, 1973           | July 2, 1973               | 189.7                     | 11.85                       |
| 61M                       | 8                         | Aug. 16, 1973           | Aug. 31, 1973              | 75.2                      | 9.4                         |
| 62M                       | 6                         | March 7, 1973           | March 20, 1973             | 121.5                     | 20.5                        |
| 63M                       | 7                         | March 7, 1973           | March 26, 1973             | 146.                      | 20.8                        |
| 64M                       | 4                         | March 19, 1973          | March 23, 1973             | 44.6                      | 11.5                        |
| 65M                       | 9                         | Aug. 30, 1973           | Sept. 10, 1973             | 65.25                     | 7.25                        |
| 66M                       | 5                         | March 19, 1973          | April 3, 1973              | 51                        | 10.2                        |
| 67M                       | 4                         | March 19, 1973          | March 23, 1973             | 22                        | 5.5                         |
| 68M                       | 3                         | March 26, 1973          | March 30, 1973             | 39                        | 13.                         |
| 71M                       | 3                         | March 26, 1973          | April 3, 1973              | 17                        | 5.6                         |

Figure 2.1



SCREENING, CATALOGING AND INDEXING REPORTS OF  
AIRCRAFT MISSION STATISTICAL DATA

Post 200 Missions

| <u>Mission<br/>Number</u> | <u>Number<br/>of cans</u> | <u>Date<br/>Started</u> | <u>Completion<br/>Date</u> | <u>Manhours<br/>Total</u> | <u>Per Can<br/>Manhours</u> |
|---------------------------|---------------------------|-------------------------|----------------------------|---------------------------|-----------------------------|
| 203                       | 17                        | Dec. 4, 1972            | Dec. 12, 1972              | 117                       | 6.88                        |
| 204                       | 15                        | Dec. 4, 1972            | Dec. 18, 1972              | 192.25                    | 13.01                       |
| 206                       | 38                        | Dec. 4, 1972            | Dec. 21, 1972              | 143.25                    | 3.76                        |
| 210                       | 20                        | Feb. 23, 1973           | March 9, 1973              | 245.85                    | 12.29                       |
| 211                       | 61                        | Dec. 13, 1972           | Feb. 6, 1972               | 539.25                    | 8.84                        |
| 212                       | 44                        | Dec. 20, 1972           | Jan. 16, 1973              | 284.25                    | 6.46                        |
| 213                       | 57                        | Jan. 17, 1973           | Feb. 16, 1973              | 377.5                     | 6.62                        |
| 215                       | 43                        | Feb. 5, 1973            | Feb. 23, 1973              | 225.75                    | 5.25                        |
| 220                       | 11                        | Feb. 20, 1973           | Feb. 26, 1973              | 104.3                     | 9.48                        |
| 232                       | 12                        | Feb. 6, 1973            | Feb. 23, 1973              | 66.5                      | 5.54                        |

Figure 2.2

215, 220, 232). The ten missions consisted of three hundred and eighteen (318) cans of film (figure 2.2).

## 2.2 Task II

The Land Use Mapping, accomplished by Caspan under contract Nas 9 12698, was divided into three phases. The first phase, the printing of a disclaimer, collating and shipping of the 21 Land Use Sheets (1st edition) to USGS, Denver, Colorado, was completed during January, 1974. The second phase, the training for data extraction from the first edition Land Use Sheets, was begun January 16, 1973, and lasted through January 22, 1973. This phase required a total of 78 man-hours. Actual data extraction (phase three) began January 23, 1973, and continued until completion on July 2, 1973. Land Use Data was extracted and recorded on computer load sheets from twenty-one (21) Land Use Sheets for data bank entry. This task required a total of 2334.8 manhours, averaging 111.11 manhours per sheet.

## 2.3 Task III

The scribing of Land Use Sheets, (2nd edition) compiled by Stephen F. Austin University, began July 11, 1973, with a basic training phase lasting through August 31, 1973. Training continued throughout production with two people being trained as scribes. The training required 677 manhours. The first production period began September 4, 1973, and was completed on November 7, 1974. The Galveston (19), Alvin (18), Houston (13), Trinity Bay (14), Rosenberg (12), Liberty (9), and Brenham (6) sheets were scribed.

SCRIBING OF LAND USE SHEETS STATISTICAL DATA

FIRST PRODUCTION

| Sheet<br>Number & Name | Starting<br>Date | Completion<br>Date | Manhours<br>per sheet |
|------------------------|------------------|--------------------|-----------------------|
| 1st Training Phase     | July 11, 1973    | August 31, 1973    | 397.5                 |
| 13 Houston             | Sept. 4, 1973    | Oct. 5, 1973       | 92.5                  |
| 14 Trinity Bay         | Sept. 4, 1973    | Sept. 21, 1973     | 78.5                  |
| 18 Alvin               | Sept. 10, 1973   | Sept. 19, 1973     | 54.5                  |
| 12 Rosenberg           | Sept. 25, 1973   | Oct. 17, 1973      | 123.5                 |
| 9 Liberty              | Oct. 5, 1973     | Oct. 26, 1973      | 89                    |
| 6 Brenham              | Oct. 16, 1973    | Nov. 9, 1973       | 103.25                |
|                        |                  | TOTAL              | 541.25                |

SECOND PRODUCTION

|                    |                |                |         |
|--------------------|----------------|----------------|---------|
| 2nd Training Phase | Jan. 28, 1974  | Feb. 1, 1974   | 37.37   |
| 18 Alvin           | Feb. 8, 1974   | June 28, 1974  | 123.5   |
| 20 Matagorda       | Feb. 25, 1974  | March 8, 1974  | 86      |
| 21 Bay City        | March 4, 1974  | April 11, 1974 | 143.9   |
| 5 Lake George      | March 12, 1974 | April 19, 1974 | 238.5   |
| 15 Hallettsville   | April 11, 1974 | April 19, 1974 | 49.1    |
| 1 Caldwell         | April 22, 1974 | April 30, 1974 | 68      |
| 5 Giddings         | May 1, 1974    | May 16, 1974   | 47      |
| 2 Bryan            | May 9, 1974    | May 31, 1974   | 48.75   |
| 10 Trinity Bay     | May 20, 1974   | June 28, 1974  | 103     |
| 19 Galveston       | Feb. 1, 1974   | Feb. 25, 1974  | 94      |
|                    |                | TOTAL          | 1051.75 |

THIRD PRODUCTION

|                    |               |                |         |
|--------------------|---------------|----------------|---------|
| 3rd Training Phase | June 5, 1974  | July 25, 1974  | 279.50  |
| 2 Conroe           | July 8, 1974  | Spt. 26, 1974  | 104.4   |
| 7 Lake Creek       | July 22, 1974 | Sept. 27, 1974 | 69.5    |
| 11 Eagle Lake      | July 29, 1974 | Nov. 1, 1974   | 133.5   |
|                    |               | TOTAL          | 307.4   |
|                    |               | Total Training | 714.37  |
|                    |               | Total Manhours | 1900.40 |

The printing of these maps involved a new technique called " Graphic Scribe Technology ", developed by Keuffel & Esser, for the photocopying of positive and negative art work at the same time. 541.25 manhours were expended on the first production phase, averaging 90 manhours per Land Use Map. Additional information is indicated on figure 2.3. The second production period began on February 8, 1974, and ended on June 28, 1974. One week was devoted to remedial training prior to the second production phase. The maps scribed were Alvin (18), Matagorda (20), Bay City (21), Lake George (17), Hallettsville (15), Caldwell(1), Giddings (5), Bryan (2), Trinity Bay (14). A third production was started on July , 1974, preceded by a 280 hour training period. A total of 12 Land Use Sheets were scribed before the compilation was ended at Stephen F. Austin University. The maps scribed during this period were Conroe (8), Lake Creek (7), and Eagle Lake (11). An explanation of the three production periods is given in section 3.0.

#### 2.4 Task IV

The collation of ERTS Investigation Reports entailed the paste up of 5 color and 9 B/W original reports. This task began on December 3, 1973. The reports: the Range, Forestry, Urban, Coastal, Signature Extension, Compendium and Agricultural Analysis Reports were assigned at random time intervals and were all completed by October 17, 1974. Preparation took a total of 1586.15 man-hours. Additional information is in figure 2.4.

ERTS INVESTIGATION REPORTS STATISTICAL DATA

| <u>REPORT<br/>NAME</u>   | <u>STARTING<br/>DATE</u> | <u>COMPLETION<br/>DATE</u> | <u>TOTAL<br/>MANHOURS</u> |
|--------------------------|--------------------------|----------------------------|---------------------------|
| FORESTRY                 | Dec. 3, 1973             | May 17, 1974               | 253.15                    |
| RANGE                    | Dec. 3, 1973             | Dec. 21, 1973              | 76.9                      |
| COASTAL                  | Dec. 14, 1973            | March 1, 1974              | 222.2                     |
| URBAN                    | Jan. 4, 1974             | March 19, 1974             | 48.7                      |
| SIGNATURE<br>EXTENSION   | April 22, 1974           | April 26, 1974             | 50                        |
| COMPENDIUM               | June 7, 1974             | Oct. 17, 1974              | 529.1                     |
| AGRICULTURAL<br>ANALYSIS | Sept. 9, 1974            | Oct. 8, 1974               | 406.1                     |

Figure 2.4

## 2.5 Task V

The reformatting and collation of SKYLAB IV Tabular and Plot Data for data bank entry was started on September 3, 1974, and completed on October 31, 1974. Seven hundred and ninety-nine manhours were required to complete the load sheets.

## 2.6 Task VI

The preparation of REDAF documents for entry into REDAF Document data base was started on November 4, 1974. All documents were entered on computered load sheets by January 15, 1974. This task entailed the assigning of codes for authors, corporate authors and extracting key words to describe the document. One thousand, four hundred and sixty-eight (1468) manhours were used in the preparation of these documents. This was basic training for the second phase, the preparation of LACIE documents for data base entry, which entailed these very same basic steps. The preparation of the LACIE documents for data base entry began on January 16, 1975, and continued through the termination of this contract on June 30, 1975. One thousand, four hundred and fifteen documents were prepared during this period. A total of 3713.45 manhours have been put into this effort averaging 2.62 manhours per document.

## 2.7 Task VII

Throughout the three (3) year period, Caspan prepared several overlays. Aircraft Missions Index's were prepared for missions 1 through 100, 100

through 150, 151 through 200, 201 through 250, 251 through 275, and 276 through 300. An overlay was also prepared covering all the University of Michigan Missions. A Mission Index has been prepared for Ames Aircraft mission 71-024 through 71-079, and 72-003 through 72-122. One hundred and thirty-three (133) Ames flights were plotted on this index. This task continues under contract NAS 9 14702. An overlay was prepared of the Large Area Crop Inventory Photograph on June 10, 1974. Updating is still continuing at present. At the end of this contract, 135.9 manhours have been put into the updating of this map.

# INDEX OF CATALOGING AND INDEXING AIRCRAFT MISSIONS STATISTICAL DATA

| MISSION<br>NUMBERS        | STARTING<br>DATE | COMPLETION<br>DATE | TOTAL<br>MANHOURS |
|---------------------------|------------------|--------------------|-------------------|
| 1-100                     | May 21, 1973     | May 29, 1973       | 188.35            |
| 100-200                   | July 2, 1974     | Aug. 16, 1974      | 120.5             |
| 200-250                   | Nov. 28, 1973    | June 14, 1974      | 185.8             |
| 251-275                   | Aug. 19, 1974    | Oct. 23, 1974      | 181               |
| 276-300                   | Oct. 28, 1974    | June 30, 1975      | 295.9             |
| University of<br>Michigan | Nov. 19, 1973    | Nov. 29, 1973      | 111.25            |

## INDEX OF CATALOGING AND INDEXING OF AMES AIRCRAFT FLIGHTS

|        |               |               |     |
|--------|---------------|---------------|-----|
| 71-024 | June 4, 1975  | June 19, 1975 | 194 |
| 71-079 |               |               |     |
| 72-003 | June 20, 1975 | June 30, 1975 | 111 |
| 72-122 |               |               |     |

Figure 2.4



### 3.0 PROBLEMS

#### 3.1 Task I

Difficulties arising during the Cataloging and Indexing task were largely caused by the untimeliness of the mission being screened. These missions were several years old and had incomplete or missing logs and imagery. A great deal of time was spent researching these missing documents. The majority of these missions were flown below 4,000 feet and had to be plotted on quadrangle maps. The ordering procedure is a lengthy process, requiring 6 to 8 weeks. This time can be reduced to 3 to 4 weeks by having the contractor order direct from USGS Distribution Centers. Both of these problems resulted in a high manhour/mission ratio. The lack of feedback from the NASA monitors during the first eleven months of contract caused a major problem when the first post-200 missions were cataloging and indexed. Caspan was not aware of new techniques and procedures that were evolving during that time. We assumed the techniques used on earlier reports were correct. A meeting with Mr. Blilie and several others led to new procedure and techniques for both Caspan and NASA to be instituted.

#### 3.2 Task II

No major problems or delays were encountered in extracting land use data from Land Use Sheets.

#### 3.3 Task III

The scribing caused few problems for Caspan, but many false starts did occur.

The first attempt at producing the Land Use Sheets were made using normal ink drafting techniques on acetate. This proved unsatisfactory in that it produced irregular line widths and was time consuming. After this, we turned to scribing and dry transfer lettering. The training period for a scribe was unknown to Caspan and NASA. It took approximately a month and a half to train a scribe. In early November, it was discovered that the Land Use boundaries did not match between adjacent sheets. This caused all scribing to stop while the sheets were revised. Consequently, all sheets had to be done a second time. Manhours are shown in figure 2.3. Production stopped again in late November, when our only trained scribe quit. This caused a loss of two months production time in hiring and training a new scribe. This person remained with Caspan until the completion of all compiled sheets.

#### 3.4 Task IV

The difficulties or problems in the collation of ERTS Reports were caused by the tedious and monotonous nature of the work. It takes constant checking and supervision to assure a quality product.

#### 3.5 Task V

No major problems or delays were encountered in the preparation of SKYLAB IV data.

#### 3.6 Task VI

The preparation of REDAF and LACIE Documents data base is tedious and monotonous work, unless you have a personal interest in the particular doc-

ument you are coding. Thus, it is essential that some other form of work be available for rotation (such as mission indexes, etc.). This, as with Task IV, necessitates careful and double checking by supervisors.

### 3.7 Task VII

The only problem encountered in the preparation of mission index or other plots is the inavailability of check lists to ensure all mission or flights has been included in the plot.

#### 4.0 CONCLUSIONS AND RECOMMENDATIONS

A Cataloging and Indexing Report of remote sensor data can be prepared by entry skill level personnel for low cost. This was accomplished by subdividing work into relatively simple steps with only the supervisor understanding the overall project. This was proven during Task I of this contract. This predication has been proven several times during the contract years. The majority of tasks were accomplished using the principle. For example, previously, the task of preparing documents for data bank entry, (assigning key words), was accomplished by using scientists, but is now being accomplished by high school graduates at Caspan with a considerable saving to NASA. Caspan strongly recommends the policy established during the last half of the contract of direct contact and training between the NASA or other contractors' personnel and CASPAN personnel eliminating as many middle men as possible.